Socioeconomic correlations in communication networks

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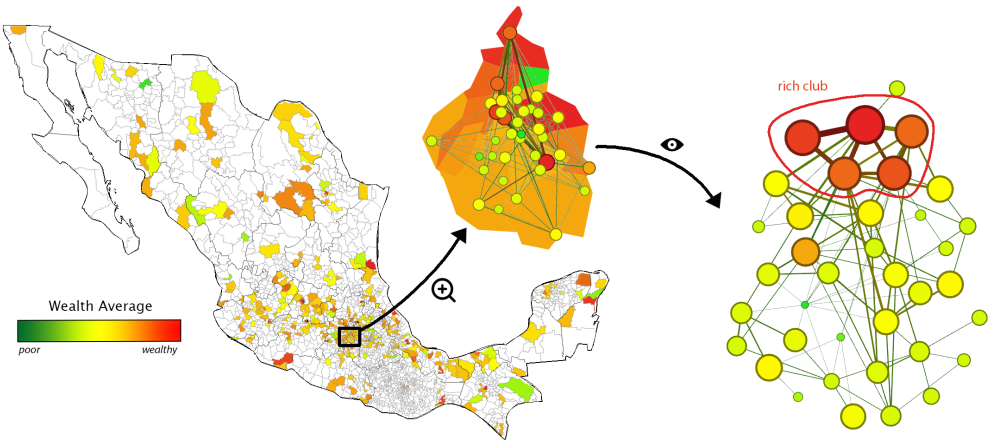
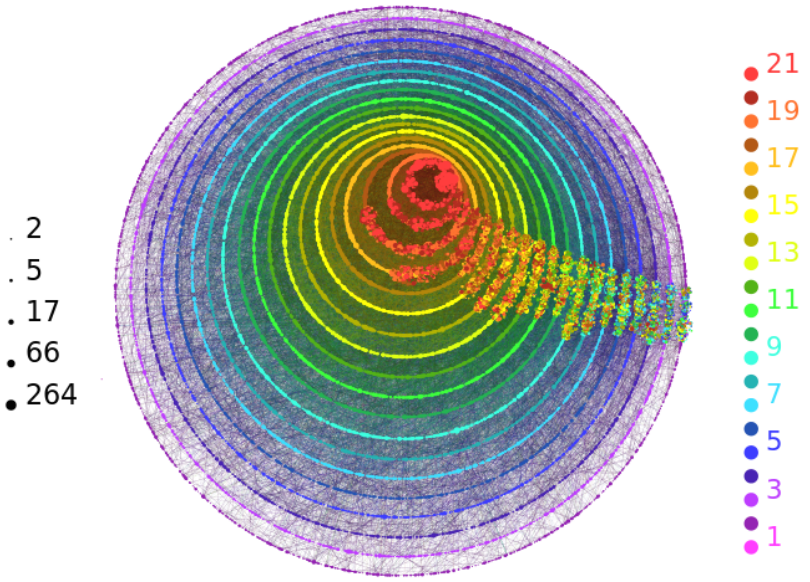
In this work we study the socioeconomic structure of a communication network by combining mobile communication records and bank credit informations of a large number of individuals living in Mexico. We provide empirical evidences about present economic unbalances suggesting not only the distribution of wealth but also the distribution of debts to follow the Pareto principle. Further we study the internal and interconnected structure of socioeconomic groups. Through a weighted core analysis we signal assortative correlations between people regarding their economic capacities, and show the existence of "rich-clubs" indicating present social stratification in the social structure.

Our understanding about the structure and dynamics of social systems has been developed considerably during the last years due to the recent availability of large digital datasets collecting interactions of millions of individuals. One of the most promising direction of studies involves mobile phone communication datasets. As mobile phones became personal items of our everyday life they are optimal to collect information about the location, communication, online, and physical activities of people, and to map out their temporally resolved social-communication network. These advancements give us to the opportunity to study the structure and evolution of very large social networks and signal general rules in human behaviour.



Geographical distribution and average economical capacities of mobile phone users in Mexico (left panel). Sample of users in Mexico City pinned at their most frequented location are depicted together with their social ties extracted from their CDRs (middle panel). The social network of selected users demonstrate the existence of "rich-clubs" in the social structure where the wealthiest people appear to be connected (right panel). Colours are coding economical capacities, the width of links scales with the wealth of the ending nodes, and the size of nodes reflects the sum of link weights for each individual.

However, although these studies consider the temporal, structural, and spatial characters of human interactions they commonly miss one important dimension regarding the economic status of individuals. Economic capacities of people may largely determine their communication and social behaviour thus the emerging structure of the global social-communication network. Studies combining the social network with economic data could help us better understand spatial, and social segregation, or economic imbalances evolving in the society.



Weighted core decomposition of the largest connected component of the mobile communication network of users with known economic status. Size of vertices represent the number of contacts of individuals in the social graph, while colours decode their economic status ranging from least (magenta) to the most (red) wealthiest group of individuals. The colour of circles are assigned according to the person's core shell determined by [5], while link colours on each end denote the shell of the connected node on the opposite end. Social stratification is evidenced by the narrow shell circles indicating that links connect mostly nodes from neighbouring shells. Components distributed radially on the right hand side are ones, which became disconnected from the largest component during the core decomposition process.

Here we propose a study, which moves along this direction by considering information about the mobile communication, location, and economic capacities of people. We use a communication dataset covering the mobile phone interactions of millions of people who are the clients of a single mobile provider in Mexico [1,2]. The data collects the geo-localised call detailed records (CDRs) for 6 consecutive months. This anonymised dataset is combined with bank credit informations of clients of a bank in the same county. The credit data collects the time, location, and amount of bank card purchases and the monthly evolution of incomes, spendings, and debts of the anonymised clients.

Using these informations we quantify the economic status of people to estimate their wealth and debts and infer these measures with the structure and evolution of the social-communication network extracted from the CDRs. We provide empirical evidences about present economic unbalances suggesting not only the distribution of wealth but also the distribution of debts to follow the Pareto principle [3,4]. We categorise individuals into different economic classes to understand the internal and interconnected structure of socioeconomic groups. Based on the economic status measures we perform a core analysis and show assortative correlations between people regarding their economic capacities. Further we provide quantitative evidences about the existence of “rich-clubs” and social stratification in the social structure.

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